Finance Models for Rural Electrification from Renewable Energy Schemes

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ABSTRACT

This paper explores different payment models for Renewable Energy (RE) schemes that have been implemented in different rural, urban and peri - urban areas in Sub-Saharan Africa. We discuss their mode of operations, successes accrued and challenges encountered. We give reasons why some have failed while others still exist and are growing stronger. The paper proffers solutions to the challenges and provides alternate models that could be adopted. The importance of providing sustainable payment models is that it would allow for the wide spread adoption/acceptability of renewable energy technologies and also ensure that RE service providers are well advised on the advantages involved in engaging with the rural poor, who are low income earners and at the bottom of the income pyramid.

INTRODUCTION

According to [1], Renewable Energy (RE) has at links to at least 10 out of the 17 Sustainable Development Goals. The Sustainable Development Goals developed by the United Nations in 2015 contains 17 different goals bothering around combating climate change, improving healthcare and education, ending poverty and hunger, gender equality and access to clean and sustainable energy [2]. Increasing access to energy especially via renewables is the key to solving many of these goals.

The answer to the question, why Renewables, can simply be answered by stating that Africa is blessed with abundance of Renewable Energy potentials from solar, wind, geothermal, hydro, bioenergy and marine [3], and the proper utilization of these resources would translate Africa into energy sufficiency whilst also protecting the environment.

Financing Renewable Energy projects in Africa would have a number of effects on the African people. One is that it would lead to more economic productivity because of the increase in energy supply [3], the second reason is environmental protection, even with the increased

economic output the environmental backlash in form of pollution experienced using conventional power generation technologies would be minimal. Another reason is the increased access to electricity.

In Sub-Sahara Africa, rural electrification is still at its prime, with only about 18 percent of rural communities having access to electricity according to Table 1. As REN21's 2016 report shows, community energy initiatives are increasingly becoming a least - cost option for power supply for households and small businesses, and particularly in rural, off grids localities.

Table 1 Electricity Access - Regional Aggregates [4]

Region	**Population without electricity**	**Electrification rate**	**Urban Electrification rate**	**Rural Electrification rate**
	Million	**%**	**%**	**%**
Developing countries	**1257**	**76.5**	**90.6**	**65.1**
Africa	**600**	**43**	**65**	**28**
North Africa	1	99	100	99
Sub-Sahara Africa	599	32	55	18
Developing Asia	**615**	**83**	**95**	**75**
India	306	75	94	67
Rest of developing Asia	309	87	95	80
Latin America	**24**	**95**	**99**	**81**
Middle East	**19**	**91**	**99**	**76**
Transition economies and OECD	**1**	**99.9**	**100.0**	**99.7**
World	**1258**	**81.9**	**93.7**	**69.0**

The reason for limited funding of renewable energy in Africa includes market related issues, political and policy related issues, technology, inherent nature of projects [5]

LITERATURE REVIEW

African Development Bank Group [6] opine that there exist numerous challenges to rural electrification in Africa such as policy and regulatory, market development, technical and capacity, structural challenges, information and importantly, financing challenges respectively. The issue of financing challenges is a fundamental concern to the current study. Examples of prominent issues in financing rural electrification projects are inadequate financing terms that are mutually beneficial to the energy companies and the low income customers, lack of risk mitigation tools and insufficient early seed support for the rural electrification projects.

According to the Group of African Agencies and Structures in charge of Rural Electrification [7] they posited that there are only two rural electrification models developed in Africa. These models did not depend on the availability sufficient domestic resources to initiate its rural

electrification program through its National Electricity Company(NEC). Model A originated from sector reforms such as privatization whereby rural electrification is developed, operated and managed by the private sector. Model B was typically for countries with sufficient financial resources to run a large scale rural electrification project which will be implemented by the NEC.

Since the Nigerian Power Sector is largely privatized, only Model A will be considered for the study. (Club-ER, 2010) estimate that countries such as Burkina Faso, Mauritania, Senegal and Madagascar have all adopted the Model A with very modest results. A decade after the projects commenced, energy rates did not increase as the companies had earlier anticipated. Several energy companies also had serious funding challenges and subsidies were not easily accessible. It should be noted that when subsidies are unavailable for rural electrification projects in impoverished neighborhoods, the project becomes unsustainable. Whereas, the implementation of the electrification project would have been a useful tool in empowering the low-income households to increase their earnings.

CONTEMPORARY MODELS FOR PRIVATE ENERGY SUPPLY

1. **Fee for service model**: In this system, the electricity provider owns the system and provides a service for the end users. It also ensures the operation, maintenance and replacement of the system, and in exchange the end users pay a certain sum every month for electricity [8]. This system is very normal and can be used by both central and local power utilities. South Africa deployed a fee-for-service program with more than 30,000 solar systems in 1999 [9], customers had to pay a fee of 100 Rand (16 US dollars in 1999) to get connected, subsequently they have to pre-pay 61 Rand (8 US dollars) monthly. The monthly payments are usually made at an energy store in areas where there are large numbers of customers, in areas where there are limited number of customers; the technicians move round to collect monthly payment and provide routine maintenance for the systems [9].

2. **Dealer model**: This system is utilized by private companies or households. The system allows an outright purchase of the household based PV systems by the system user from the dealer or retailer [8]. Kenya and Sri Lanka are good examples of successful implementation of the dealer model [10].

3. **Consumer Finance**: In this case the customer purchases the system on credit from a dealer and afterwards make periodic down payment, the payment of the loan is usually handled by a small scale unregulated financial institution. In order for consumer financing to operate at its best, some key issues like creditworthiness of the customer and the financial institution, system quality and warranties provided by the dealer and other contractual arrangements between the dealer and the loan financing institution and also agreements between the loan financing institution and the customer [5].

~~3.~~4. **Lease model**: This system is utilized by system users who may not have the funds to purchase the equipment or only need the PV system for a short-term period. The equipment is leased to the system user who pays a predetermined price periodically while the system remains in his/her possession. At the end of the lease period, the equipment may or may not be transferred to the end-user. During the lease period, the lease holder (company) remains owner of the system and therefore responsible for the maintenance

and repair [8]. The main difference between leasing and the Consumer financing is the idea that since the leasing holder remains the legal owner of the product during the lease, any customer defaulting in payment could easily be discontinued from service [5].

Typically, most private electricity providers use any of the four models in their operations or a combination of some of models to develop an optimal strategy depending on the markets in which they operate. An example is a company called Mobisol [10] which utilizes a repayment program called Rent to Own. It operates and maintains renewable electricity equipment supplied to households in East Africa with a repayment period of three years and the monthly installment payment of a fixed amount which can be paid using a mobile phone by the household member.

METHODS – FINANCING INSTRUMENTS FOR RURAL RENEWABLE ENERGY

Some other financing instruments that have been used to facilitate the adoption of renewable energy includes Grants, Subsidies, Joint Ventures, Import Duty Reduction, Renewable Energy Service companies, Reduction in value-added tax, Venture Capital/Private Equity, Low Interest and Long term loans and Asset Financing [11]. Table 2 shows different fiscal incentives and public financing favored by government in Sub-Saharan Africa.

TABLE 2: Different Fiscal Incentives and Public Financing tools used by Governments in Sub-Saharan Africa

Countries	Capital subsidy, grant, or rebate	Investment or production tax credits	Reduction in sales, energy, CO2, VAT, or other taxes	Production payment	Public Investment, loans or grant
Algeria		*			
Angola					*
Benin			*		
Botswana	*		*		
Burkina Faso		*	*	*	
Cabo Verde			*	*	
Cameroon			*		
Cote d'Ivoire			*		
Egypt	*		*		
Ethiopia			*		*
Gambia			*		
Ghana	*		*		*
Guinea			*		
Kenya			*	*	*
Lesotho					*
Libya			*		
Madagascar			*		
Malawi			*		

Mali			*		*
Mauritius	*				
Morocco					*
Mozambique					*
Niger			*		
Rwanda			*		*
Senegal			*		
South Africa	*		*		*
Sudan					
Tanzania			*		
Togo			*		
Tunisia	*		*		*
Uganda	*		*		*
Zambia	*		*		

Extracted from IRENA, 2013 [3]

Some of the sources of financing renewable energy projects asides from Government and Private Sector Finance includes but not limited to International multilateral funding from World Bank, Global Environmental Facility (GEF) or the European Union. Regional development banks like the African Development Bank (AfDB), the East African Development Bank (EADB), the Development Bank of South Africa, the inter-American Development Bank (IADB), the Islamic Development Bank (IDB). Some other Bilateral agencies like the Department for International Development (DFID, UK), the Agency for International Development (USAID, UK), the international Cooperation Agency (JICA, Japan), the Agency for International Development (AusAID, Australia) [5].

PROPOSED MODELS FOR PRIVATE ENERGY SUPPLY

Buy- (Buy & Sell)-Pay model

The Buy-Sell-Pay model is developed with the intention to provide affordable Renewable Energy Systems (RES) to Micro, Small and Medium Enterprises whilst educating them on their present energy cost/expenses and the different business outputs they could engage in with their RES and stay more profitable. As the customers become more profitable then it would be possible for them to pay up their lease and even purchase larger RES.

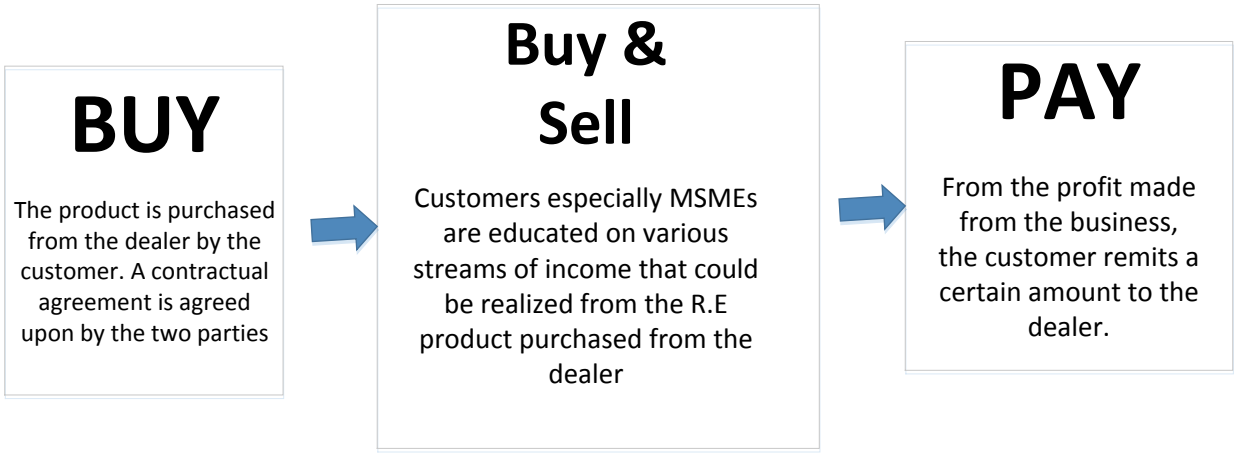

Figure 1: The Buy, (Buy & Sell), Pay Model

Rent or Own model

We propose a rent or own scheme which allows us to provide household renewable electricity equipment to households on a small scale. This system is a combination of the lease model and the dealer model. We allow the households to either purchase the PV system outright or rent the equipment up until they have adequate funds to purchase the equipment. The rent fee can be structured to have a project repayment period of five years. During this period, households that choose to rent will pay a certain predetermined amount weekly to continue to enjoy full access to the electricity generated by the equipment.

The program will be controlled by inserting a sensor into the equipment to discontinue providing electricity to households who fail to pay the required weekly remittance. During the rent period, the equipment will remain the property of the energy provider and the maintenance of the equipment will be the responsibility of the energy provider. Any damage to the equipment will be levied on the households except during the occurrence of a natural disaster which caused direct damage to the product.

The scheme allows the energy provider to reap returns from the energy providing equipment either through rent or through sale. Such proceeds can be reinvested into the company to ensure the sustainability of the project. The service can also be scaled to serve communities and towns in rural areas. The goal of the Rent or Own scheme to create a mutually beneficial financial arrangement that suits both the energy provider and the low-income households.

CONCLUSION

Financing Rural Electrification schemes in Africa would go a long way to increasing energy access in Africa. This paper has identified different financing instruments and payment models adopted in Sub-Saharan Africa. We also identified different countries in SSA and how they have run pilots using the payment models. Governments initiatives towards fiscal incentives and public financing tools engaged with in Countries in SSA have been highlighted. Also, two new models; the Buy, (Buy & Sell), Pay and the Rent or Own model have been proposed and developed.

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